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COMPACT AUTO ID READER AND RADIO FREQUENCY TRANSCEIVER DATA COLLECTION MODULE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention generally relates to portable data collection and methods of collecting data, especially from bar code symbols, smart cards, or other auto-ID media, in mobile computers having a wireless transceiver for a local area network.

Wireless local area networks use infrared or radio frequency communications channels to communicate between portable or mobile computer terminals and stationary access points or base stations. These access points are in turn connected by a wired (or possibly wireless) communication channel to a network infrastructure which connects groups of access points together to form a local area network, including, optionally, one or more servers or host computer systems.

One type of mobile computer terminal coupled to or incorporating a bar code symbol reader, are now very common for data collection applications. Typically, a bar code symbol comprises one or more rows of light and dark regions, typically in the form of rectangle. The relative widths of the dark regions, i.e., the bars and/or the widths of the light regions, i.e., the spaces, between the bars encode data or information in the symbol.

A bar code symbol reader illuminates the symbol and senses light reflected from the regions of differing light reflectivity to detect the relative widths and spacings of the regions and derive the encoded information. Bar code reading type data input systems improve the efficiency and accuracy of data input for a wide variety of applications. The ease of data input in such systems facilitates more frequent and detailed data input, for example to provide efficient taking of inventories, tracking of work in progress, etc.

A variety of bar code reader scanning systems are known. One particularly advantageous type of reader is an optical scanner which scans a beam of light, such as a laser beam, across the symbols. Laser scanner systems and components of the type exemplified by U.S. Patent Nos. 4,387,297 and 4,760,248 which are owned by the assignee of the instant invention and are incorporated by reference herein have generally been designed to read indicia having parts of different light reflectivity, i.e., bar code symbols, particularly of the Universal Product Code (UPC) type, at a certain working range or reading distance from a hand-held or stationary scanner.

Wireless and radio frequency (RF) protocols are known which support the logical interconnection of portable roaming terminals having a variety of types of communication capabilities to host computers. The logical interconnections are based upon an infrastructure in which at least some each of the remote terminals are capable of communicating with at least two of the access points when located within a predetermined range therefrom, each terminal unit being normally associated with and in communication with a single one of such access points. Based on the overall spatial layout, response time, and loading requirements of the network, different networking schemes and communication protocols have been designed so as to most efficiently regulate the communications between a given terminal and the network through the selected access point. One such protocol is set forth in the ISO/IEC 8802-11, or ANSI/IEEE Std 802.11 entitled "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications" (1999 edition) available from the IEEE Standards Department, Piscataway, NJ (hereinafter the "IEEE 802.11 Standard"), and another is Bluetooth.

In automatic identification and data capture (AIDC) industry, certain module form factors, i.e., specific space allocations assemblies or devices having known functionalities, have become standards. The PC card or compact flash card is one such example in the portable computer industry. One such form factor for a bar code reader laser scan engine module known as the "SE 1200" has been adopted by the AIDC industry and is produced by Symbol Technologies, Inc. of Holtsville, New York, the assignee of the instant application. The SE 1200 module is used in hand-held portable computers for reading bar code symbols and has a parallelepiped shape measuring 1- ½ inches in length, 1 inch in width, and ¾ of an inch in height.

However, since this form factor is standardized and, therefore, the space allocated in the portable computer is limited to a certain, fixed size and shape, the functionality that may be implemented in the module is limited, since additional circuits and functions cannot readily be added to the existing allocated space. Also, the input and output interfaces of this module are fixed, and any new functions or circuits must employ the given interfaces.

SUMMARY OF THE INVENTION

1. Objects of the Invention

Accordingly, it is a general object of this invention to combine an RF transceiver and an auto ID reader on a common support, especially on a standard form factor such as the SE 1200 module.

It is another object of this invention to add further interface functionality to a module having a standardized form factor by utilizing common digital signal processing circuitry interface already present on the module to support the added functionality.

2. Features of the Invention

In keeping with the above objects and others which will become apparent hereafter, one feature of the present invention resides, briefly stated, in a radio frequency (RF) transceiver and a auto ID reader both supported on a common support having a predetermined form factor, especially the aforementioned SE 1200 module on which a bar code symbol reader is already supported. The RF transceiver is operative for communicating with a computer network, such as a wireless LAN or WAN, or cellular telephone network, The auto ID reader is operative for sensing encoded data on a card, such as a credit, debit or identification card, and for reading the encoded data.

In a preferred embodiment, electrical components for the RF transceiver and auto ID readers are mounted on a printed circuit board supported by the module. These components generate digital signals corresponding to the RF signal data and the encoded data. An ASIC, digital signal processor, microprocessor, or other processing unit supported by the module receives and processes these digital signals, and outputs the processed signals through a common interface.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages

thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of an RF transceiver and a auto ID reader circuit together with an optional bar code symbol reader circuit in accordance with this invention;

FIG. 2 is a perspective view, from the front and below, of a module for supporting the circuits of Fig. 1;

FIG. 3 is a perspective view, from the rear and below, of the module of FIG. 2; and

FIG 4 is a perspective view of a data collection terminal having the module of FIGS. 2-3 therein during a card reading procedure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Details of the present invention will now be described, including exemplary aspects and embodiments thereof. Referring now to the drawings, reference numeral 10 generally identifies a block diagram of a module according to this invention. Module 10 includes an RF subassembly 12 having a wireless data transceiver 14 for emitting RF energy via an antenna 16 to communicate with a remote base station 18 associated with a computer network 20. The RF subassembly 12 may use any low power, communications protocol, such as Bluetooth, and is operative for transmitting data collected by the auto ID reader directly to the base station 18 and thereby to the network 20. The auto ID reader may be a bar code reader, a smart card reader, a digital sensor, a biometric sensor such as a fingerprint

detector, a magnetically encoded data reader (e.g. a disk reader or a stripe reader), or an optical or OCR reader, etc.

The base station 18 emits an RF signal which is detected by the antenna 16 in the module. A second antenna 17 may also be deployed in the module for antenna diversity, and when we refer to the "antenna" we shall mean either antenna 16 or 17. The received RF signal, for communications protocol synchronization or acknowledgement purposes, is conducted to the wireless transceiver 14 which performs RF demodulation and thereupon the analog baseband signal is processed in a signal processor 22, preferably a single integrated circuit, which comprises an amplifier, a bandpass filter, a multiplier for sampling the received signal at a rate controlled by a counter to produce a sampled signal, a peak detector for determining the magnitude and duration of the peaks in the sampled signal, an automatic gain controller, and a digitizer for converting the analog sampled signal to a digital signal. The digital signal is then conducted to a digital signal processor, ASIC, or microprocessor which will be referred to as the central processor unit (CPU) 24 for processing in accordance with a stored algorithm. A memory 26 is connected to the CPU for data storage and retrieval. An output signal from the CPU is conducted therefrom through an interface, typically a single eight-pin connector 28 to control functions in the terminal, e.g. display or manual data input.

Reference numeral 30 generally identifies an auto ID reader circuit having at least one sensor 32, and preferably a plurality of sensors, connected to a signal pre-processor circuit 34. A card 40 such as a credit, debit or identification card of generally rectangular

form in a preferred embodiment includes a smart card chip 36 that has information encoded therein.

The card 40 may have user identification thereon in human-readable from such as name and address data 38, or a photograph of the card's owner, or other information relating to the user, such as biometric data (a fingerprint), insurer data (in the case of a medical or patient card), motor vehicle data (in the case of a vehicle license and registration card), financial institution data (in the case of bank, credit or debit cards), etc. The card 40 may have any or all of the above data in machine-readable form such as bar code symbols in either one-or-two dimensional format, or a magnetic stripe 37.

The card 40 may have additional integrated chips embedded therein as in the case of "smart" cards, or may even have the resonant elements for use in connection with RF tag readers. In each case, the card has a longitudinal direction along which the magnetic stripe 37 extends. This edge 44 serves as a guide and insures that the chip 36 is correctly positioned relative to the sensor 32 as the card is positioned with respect to the electric contacts of the sensor as is common with smart card technology.

The contacts associated with the sensor 32 detects the data encoded in the chip and generates an electrical data signal which is then processed and digitized in the signal processor 22 to obtain a digital signal which is conducted to the RF transceiver 12 for transmission to an external computer network, or to the CPU 24 for further processing in accordance with a stored algorithm. The output signal from the CPU is fed to the output interface 28 to the mobile unit, and/or to the RF transceiver 12 for transmission to the external computer network.

As described so far, the RF transceiver 12 and the auto ID reader circuit 30 share the common CPU 24 and, preferably share some of the signal processing and digitizer components in the signal processors 22. Various aspects of the signal processors 22 may be implemented in digital circuitry, or in computer hardware, firmware, software, or in combinations of them. Apparatus of the invention may be implemented in computer products tangibly embodied in a machine-readable storage device for execution by a programmable processor, or on software located in memory. The foregoing techniques may be performed, for example, single central processor, a multiprocessor, one or more digital signal processors, gate arrays of logic gates, or hardwired logic circuits for executing a sequence of signals or program of instructions to perform functions of the invention by operating on input data and generating output. The methods may advantageously be implemented in one or more computer programs that are executable on a programmable system including at least one programmable digital signal processor coupled to receive data and instructions from, and to transmit data and instructions to, a data storage system, at least input device, and at least one output device. Each computer program may be implemented in a high-level procedural or object-oriented programming language, or in assembly or machine language if desired; and in any case, the language may be compiled or interpreted language. Suitable processors include, by way of example, both digital signal processors, or general and special purpose microprocessors. Generally, a processor will receive instructions and data from read-only memory and/or random access memory. Storage devices suitable for tangibly embodying computer program instructions and data include all forms of non-volatile memory, including by way of example, semiconductor devices, such as EPROM, EEPROM,

and flash memory devices; magnetic disks such as internal hard disks and removable disks; magneto-optical disks; and CD-ROM disks. Any of the foregoing may be supplemented by or incorporated in, specially designed application-specific integrated circuits (ASICS).

As shown in FIG. 2, reference numeral 50 generally identifies a common support such as the aforementioned SE 1200 laser scan engine module on which the RF transceiver and an additional auto ID reader circuits 12, 30 are supported. The support 50 includes a generally planar base 52 and a printed circuit board 54 mounted in a plane generally parallel to and elevated relative to the base 52.

The support 50 also optionally includes a second auto ID reader, which is illustrated as a laser scan engine subassembly 64 depicted in FIG. 1, and including a laser diode 66 for emitting a laser beam, lenses 68 for focusing the laser beam, a scan mirror 70 for reflecting the beam outwardly of the module, a drive 72 for moving the scan mirror and sweeping the beam across a bar code symbol 80 for reflection therefrom, a photodiode 74 for detecting the reflected light, and a collection mirror 76 and collection optics 78 for collecting the reflected light and directing it to the photodiode, as well as signal processor and digitizer circuitry 82 for processing and digitizing a detected signal generated by the photodiode.

The symbol 80 is machine readable and is one-or two-dimensional. The symbol 80 is associated with a target or object 84 and identifies the object.

In the event a second auto ID reader is included in the module 10, data signals from the reader are also preferably processed in the common signal processor 22.

FIG. 3 depicts an opposite side view of the support FIG. 2, in which the auto ID sensor 32 is depicted. The sensor 32 is recessed into the support so that the maximum form

factor dimensions of the SE 1200 will not be exceeded. The RF transceiver circuit 12 is mounted on the printed circuit board 54, or may be mounted on another printed circuit board mounted on the module.

FIG. 4 depicts a hand-held data collection terminal 60 in which the module of FIGS. 2 and 3 is mounted during contact of the card 40 the sensor 32. A card reading slot 62 is formed in the terminal for accepting and positioning the card 40 with respect to the sensor 32.

It will be understood that each of the elements described above, or two or more together, also may find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a combined multiple auto ID reader and radio frequency transceiver in a data collection module, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.